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Trends in Antibiotic Sensitivity *

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Introduction

Antibiotic resistance is an increasing problem. The 'Antibiotic Sensitivity Active Surveillance System' began in Louisiana with the collection of aggregate data in 2000 to track the emergence of antibiotic resistant organisms. This surveillance program, which allows the state to track and evaluate antibiotic resistance trends, monitors three pathogens: Drug resistant *Streptococcus pneumoniae* (DRSP), Methicillin resistant *Staphylococcus aureus* (MRSA) and Vancomycin resistant enterococcus (VRE). The primary goal of the Antibiotic Sensitivity Active Surveillance System is to estimate the proportion of selected bacteria in the state that are resistant to antibiotics by the reporting of laboratory aggregate data.

Methods

Over the past four years, forty-three hospitals have been a part of the surveillance system at some point in time. Currently, twenty-seven hospitals provide information to the surveillance system each month on a brief reporting form. Each hospital reports the total number of *S. pneumoniae*, *S. aureus* and enterococcus species isolated in their lab for each month. In addition, they also report the total number of drug resistant or drug intermediate resistant isolates for each of those organisms. As duplicates are not reported, the forms contain counts on one isolate of DRSP, MRSA, or VRE per patient per hospital visit. Each report is entered into an Access database and from this database, quarterly and annual summary reports are generated for the participating hospitals.

The purpose of this analysis is primarily to determine if the rates of antibiotic resistance for *S. pneumoniae*, *S. aureus* and enterococcus were significantly different over the four quarters in 2003 and secondarily to determine if there is a significant trend in the rates of antibiotic resistance for these organisms from 2000 to 2003. Since interest was in resistance as either present or not present, the resistance and intermediately resistant variables were combined to get one variable for resistance.

For each organism of interest, a chi-square statistic was calculated to determine if the percent of resistant isolates was different from quarter to quarter in 2003. Using the annual rates, a test for trend was conducted using the Mantel-Haensel Chi Square statistic. Both of these analyses were conducted using SAS (Version 8.02; Cary, NC).

Results

The results of the analysis of 2003 quarterly counts of antibiotic susceptible and resistant isolates can be seen in Table 1.

Table 1: Analysis of Antibiotic Resistance by Quarter for *S. pneumoniae*, *S. aureus*, and Enterococcus species from the Louisiana Antibiotic Sensitivity Active Surveillance System, 2003

		First Quarter	Second Quarter	Third Quarter	Fourth Quarter	X ²	p-value
<i>S. Pneumoniae</i>	Resistant	159	84	80	109	3.9057	.2718
	Susceptible	193	142	108	161		
	% Resistant	45.17%	37.17%	42.55%	40.37%		
<i>S. aureus</i>	Resistant	1672	2446	3296	2297	17.5384	.0005
	Susceptible	1452	1753	2467	1753		
	% Resistant	53.52%	58.25%	57.19%	56.72%		
Enterococcus	Resistant	3	14	139	132	9.5472	.0228
	Susceptible	68	332	1763	2283		
	% Resistant	4.23%	4.05%	7.31%	5.47%		

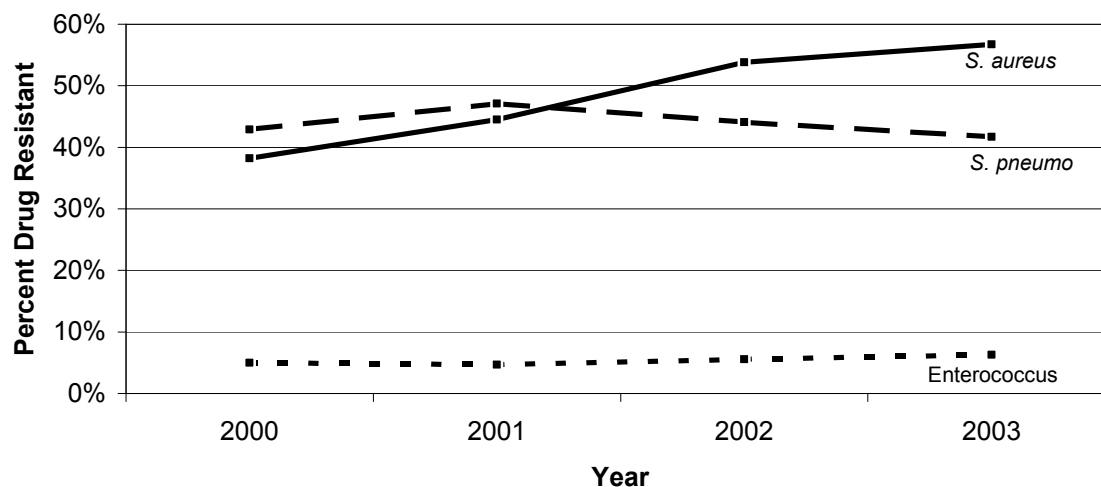
The percentages of drug resistant *S. pneumoniae* were not significantly different from each other ($\chi^2=3.9057$, $p=0.2718$), ranging from 37.2% to 45.2% in 2003. The rates for Methicillin resistant *S. aureus* were significantly different throughout the year ($\chi^2=17.5384$, $p=0.0005$), ranging from 53.5% to 58.3%. The data from 2002 has shown an increasing trend with MRSA that proceeded up to the second quarter in 2003 where a decline is now being seen. The percentages of Vancomycin resistant enterococcus (VRE) ranged from 4.3% to 7.3% in 2003. These rates were found to be significantly different from each other when using an $\alpha=0.05$ ($\chi^2=9.5472$, $p=0.0228$).

A trend analysis was conducted to determine if the rates of resistance were increasing over the past four years (2000, 2001, 2002 and 2003). The results can be seen in Table 2 and Figure 1.

Table 2: Trend Analysis of Resistance for *S. pneumoniae*, *S. aureus*, Enterococcus species, 2000-2003

		2000	2001	2002	2003	χ^2 (for trend)	p-value
<i>S. Pneumoniae</i>	Resistant	547	662	548	432	0.8504	0.3564
	Susceptible	729	744	696	604		
	% Resistant	42.87%	47.08%	44.05%	41.70%		
<i>S. aureus</i>	Resistant	4560	6682	9489	9711	1192.8963	<.0001
	Susceptible	7377	8347	8152	7425		
	% Resistant	38.20%	44.46%	53.79%	56.67%		
Enterococcus	Resistant	451	496	647	288	22.0779	<.0001
	Susceptible	8577	10013	9327	4446		
	%Resistant	5.00%	4.95%	6.49%	6.08%		

Figure 1: Percent drug resistant *Streptococcus pneumoniae*, *Staphylococcus aureus* and Enterococcus species, 2000-2002



A Mantel-Haensel chi-square statistic was calculated for each organism. The rates of drug resistant *S. pneumoniae* have not been increasing over the past four years (χ^2 for trend =0.8504, $p=0.3564$). The rates of methicillin-resistant *S. aureus* have increased from 2000 to 2003. These increases were highly significant (χ^2 for trend =1192.9, $p<0.0001$). Rates of Vancomycin resistant Enterococcus appeared to be significantly different over the past four years (χ^2 for trend =22.0779, $p=0.0001$). However, this may be attributed to the underreporting in 2003 that was due to the change in VRE's case definition (Sept. 2002).

* Based on the May-June 2003 Louisiana Morbidity Report